A Eulogy for Wireload Models

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Agenda

- Process to generate WLMs
- What has worked
- WLM Limitations
- Conclusion

(grow) TI
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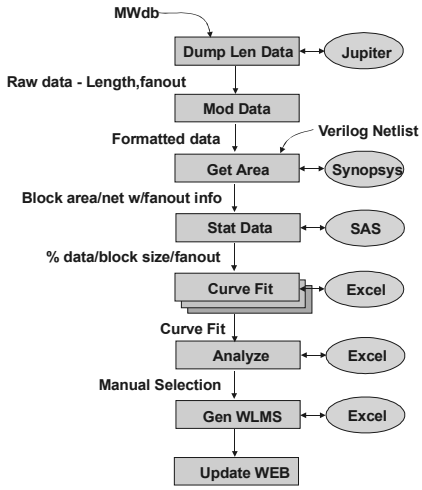
Process to Create WLMs



Example - Raw Interconnect Data

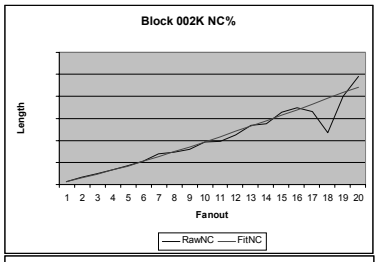
Fanout, Length, Block Size

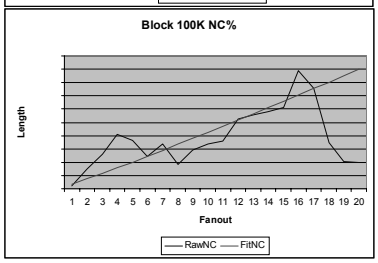
1 287.142060 1161797.750000 smrxd2
1 14831.449709 1161797.750000 smrxd3
1 278.272688 1161797.750000 smrxd4
1 15070.124023 1161797.750000 cpu_data_out[3]
1 370.995372 1161797.750000 smrxd5
1 14015.275447 1161797.750000 smrxd6
1 418.839370 1161797.750000 smrxd7
1 17413.700977 1161797.750000 smrxd8
1 268.563986 1161797.750000 qptx_data[26]
1 501.278544 1161797.750000 smrxd9
1 279.827457 1161797.750000 qptx_data[18]

Example - Percentile WLM Data

Design	Blk Size	Fanout	Count	Percent	BC	NC	WC
ALLDR	002K	1	472350	37.96	27.48	61.78	119.66
ALLDR	002K	2	105118	8.45	79.77	160.59	305.47
ALLDR	002K	3	42087	3.38	135.2	247.28	410.56
ALLDR	002K	4	19981	1.61	192.18	332.32	539.28
ALLDR	002K	5	9020	0.72	256.11	435.23	703.64
ALLDR	002K	6	7400	0.59	340.69	533.88	792.57
ALLDR	002K	7	5029	0.4	405.24	689.06	1058.7
ALLDR	002K	8	6662	0.54	458	727.4	1173.21
ALLDR	002K	9	2893	0.23	522.15	794.91	1321.42
ALLDR	002K	10	2657	0.21	602.5	958.12	1610.64

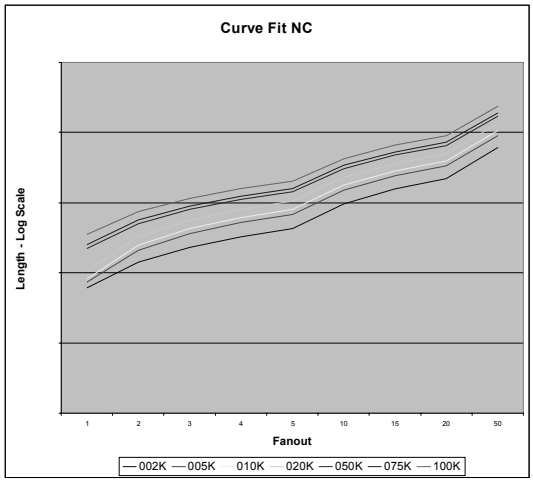
Curve Fitting



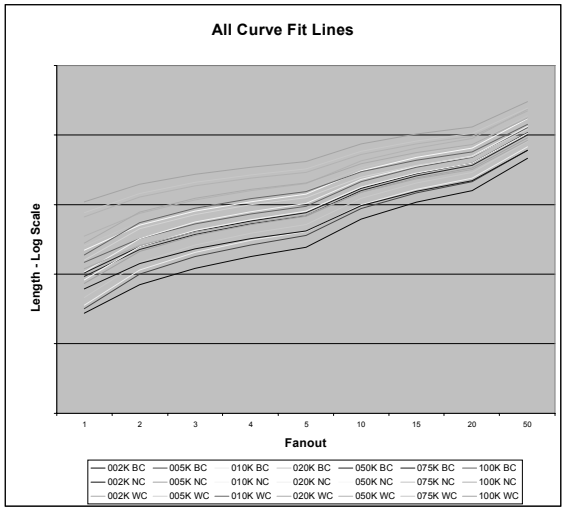


- Use Excel's Solver
- Weight number of nets at fanout point
- Use formula
- Length = AX^Y
- X = Fanout, A and Y fit variables
- In general, get good curve fits.
- Lower (2K, 5K) block sizes give better results.
- Higher (20K+) block sizes - more variation

Overlay NC - Strong, Nom, Weak



Overlay All - Strong, Nom, Weak

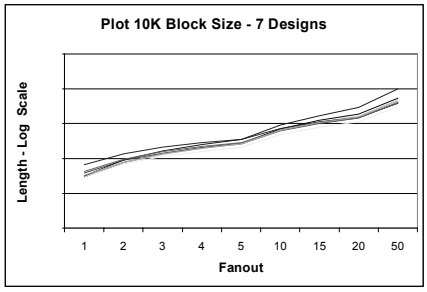


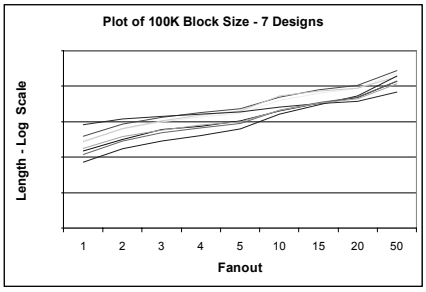
Block Sizes

- Current block sizes include 2K, 5K, 10K, 20K, 50K, 75K, 100K.
- Variation increases in 20K and above block sizes - design dependent. Recommend doing custom model for top level routes.

Comparing Individual Designs

Larger blocks sizes have greater variation





Designs Used

	Library	Info Used	MWAdjust	XLM	XLM - Mult	Gates	Nets
TImePilot Update							
Design 1	GS20	DR	0.5	4	1	.8M	394K
Design 2	GS20	DR	0.5	4	1	.6M	246K
Design 3	GS20	DR	0.5	4	1	.2M	40K
Design 4	GS30	DR	0.35	5	1.22	.4M	170K
Design 5	GS20	DR	0.5	4	1	.2M	71K
Design 6	GS20	DR	0.5	4	1	.4M	281K
Design 7	GS20	DR	0.5	4	1	.2M	39K

Conservative vs. Aggressive Models

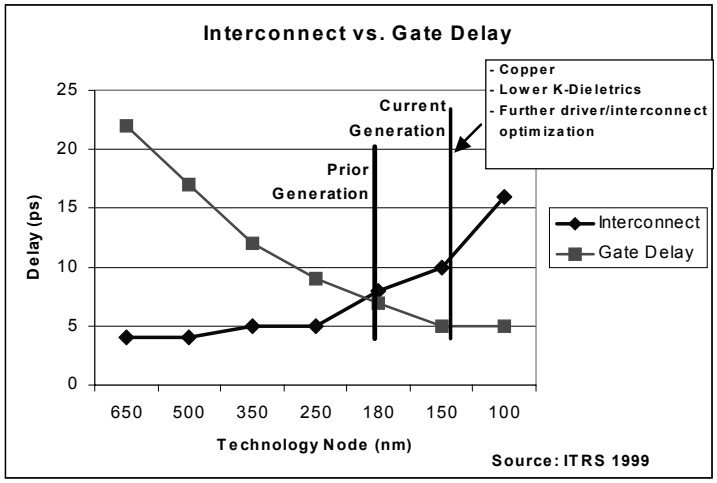
- Too conservative (long wires)
  - Larger die
  - Harder to route
  - Could make it harder to meet timing
  - Underutilizes technology capability
- Too aggresssive (short wires)
  - Create too many timing violations
  - Easier to route
  - Exceed capability of technology

- GOAL - WLMs designed so that timing will be achieved after 1-2 timing correction cycles

Why did WLMs Work

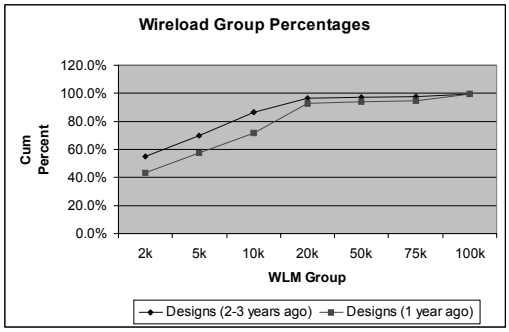
- A higher number of fanouts require more wire
- Contribution of interconnect on delay was less significant than gate delay
- With congestion or wire length based placement there was randomness in the wire lengths that made up the critical path

Limits on WLMs



Limits on WLMs

- Larger design sizes are producing a higher percentage of wires in bigger block sizes.



Limits on WLMs

- Timing driven placement is creating shorter wires on critical nets. Marginal change in overall wirelength.
- Smart datapath synthesis and placement creating much shorter wires on a portion of the design.

Conclusion

- Wireload models worked ok on .25u and above designs that use congestion or wire-length based placement.
- Advanced process technologies and improved timing driven placement and routing technologies are limiting the usefulness of WLMs.
- WLMs will fade away over the next couple of years.